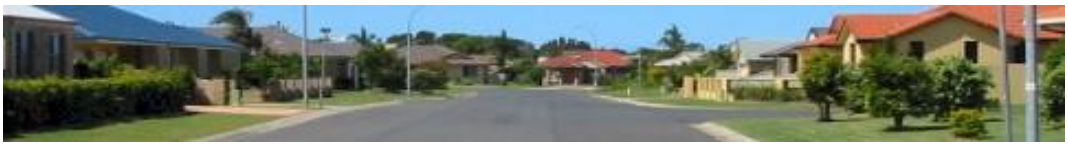

clarence valley
COUNCIL

CLARENCE VALLEY COUNCIL

SUSTAINABLE WATER REQUIREMENTS.

Information for Applicants.

In force from 29 July 2022

Acknowledgments.

This document was developed by a steering committee consisting of the former councils of Copmanhurst, Grafton, Maclean, Pristine Waters, North Coast Water and Clarence River County Council with input from the Department of Planning Infrastructure and Natural Resources, the Department of Environment and Conservation, and the Stormwater Extension Officer Program (North Coast).

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Document Information

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			consistency with Northern Rivers Local Government Development Design and Construction Manual for water quality targets		2022

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1 INTRODUCTION

This document must be read in conjunction with the Clarence Valley Councils Sustainable Water Development Control Plan. It provides detail of the requirements necessary for development to meet the standards required in the Clarence Valley Sustainable Water DCP. This is not a statutory document and will be amended to over time to take into account contemporary "best practice", innovation, and changes in relevant standards and legislation. It is intended to provide assistance and further definition for measures needed to meet the requirements of the Development Control Plan.

1.1 DEFINITIONS USED IN THIS DOCUMENT.

The following definitions apply to this document only:-

Acid Sulphate Soils – are soils that have elevated sulphide levels, in the form of iron pyrite. They have the potential to become highly acidic if exposed to oxygen. *Acid Sulphate Soils Planning Maps* prepared by the former Department of Land and Water Conservation and some Councils can be used to assess probability of occurrence. Additional surveys may be required to determine the occurrence of acid sulphate soils.

Blackwater – is wastewater that contains human excreta.

Coarse Sediment – This term refers to contaminant particles between 0.1 mm and 5 mm.

Combined Roofwater Storage – this term refers to the combined total storage volume of devices such as rainwater tanks, gutter storage systems etc. The term has been used so as not to exclude the use of gutter storage systems and allow the use of multiple storage devices, such as above and in ground tanks, to capture rainwater.

Constructed wetland – man made artificial water body containing aquatic plants and designed to mimic the ecological and physical treatment processes of natural wetlands.

Cut and fill – is development where the upwards slopes of the land are excavated and downwards filled to create a terraced landform for building.

Detention and On Site Detention (OSD) –refers to the holding of runoff for short periods to reduce peak flow rates and later releasing it into natural or artificial watercourses to continue in the hydrological cycle. The volume of surface runoff involved in this process is relatively unchanged

Development on fill - is development which artificially raises the natural ground surface level of a site.

Ecologically Sustainable Development - The Australian National Strategy for Ecologically Sustainable Development (ESD) defines ESD as " *using, conserving and enhancing the community's resources so that ecological processes, on which life depend, are maintained, and the total quality of life, now and in the future, can be increased* " (NSED, 1992 on Environment Australia at www.erin.gov.au).

Erosion and Sediment Control Plan – is a plan that specifies erosion and sediment control measures as described in the Department of Housing and former Department of Land and Water Conservation publication "Managing Urban Stormwater : Soils and Construction".

Fine Sediment – this term refers to contaminant particles less then 0.1 mm.

"Fit for purpose" no higher quality of water should be used for a purpose that can tolerate a lower grade.

Floodplain – means the floodplain level nominated in a Local Environment Plan or those areas inundated as a result of a 1 in 100 flood event if no level has been nominated.

Greywater –is water from the shower, bath tub, spa bath, hand basin, laundry tub, clothes washing machine, kitchen sink and dishwasher. Greywater is the component of sewage which does not come from a toilet or urinal.

Gross Pollutants – Trash litter and vegetation larger then 5 mm.

Gross Pollutant Trap – is a structure which traps gross pollutants for certain design storm events.

Impermeable or impervious Surface – is a surface that prevents infiltration of water into the ground and subsequently increases stormwater flows. Impermeable surfaces includes roads, footpaths, roofs, concreted sections, paved (non porous) sections, and heavily compacted soils.

Indigenous species – is a species that is an Australian native which is naturally occurring (not introduced) to the local area and which has genetic material from that area.

Infill Development– is development in mainly developed areas taking up the vacant space that may be available

Infiltration System – is a system which uses permeable material to infiltrate water into the soil. This includes infiltration trenches, infiltration wells (eg leaky well), infiltration basins and on site retention.

Nutrients – Total Phosphorous (TP) and Total Nitrogen (TN).

On-site Detention – is a stormwater storage device that attenuates the peak stormwater flow by temporary storage of all or part of the stormwater flows.

Open Space – Council Land, Crown Lands, private recreation and leisure facilities, and the public spaces of the city including river foreshores and road verges.

Pervious or permeable surfaces –allows infiltration or passage of water or other liquids.

Pre Development – condition of site at lodgement of DA.

Primary treatment : primary treatment, or a primary treatment device, is treatment which screens gross pollutants and results in the sedimentation of coarse particles.

Retention and on site retention (OSR)- refers to procedures and schemes whereby stormwater is held for considerable periods causing water to continue in the hydrological cycle via infiltration, percolation, evapotranspiration, and not via direct discharge to watercourses." This description should be expanded to include rainwater tanks of various types.

Riparian Corridor – is a corridor of vegetation along the edge of a waterway that is intimately linked with the waterway. This corridor performs numerous functions including filtering run-off and providing habitat for fauna. Council may require a corridor protection bond for development on lands identified as containing an ecological corridor.

Roofwater – means water produced by runoff from the roof catchment.

Roofwater Tanks / Roofwater Storage / Rainwater Tanks. The term "roofwater tanks", "rainwater tanks" or "roofwater storage" are all used interchangeably throughout the document and includes any devices used to capture and harvest the rain runoff from the roof of houses. The term does not specifically infer "Rainwater Tanks" and includes devices such as roofsaver gutter systems, and in ground and above ground tanks regardless of type, material or size and constructed in line with the relevant Australian Standards for the chosen purpose.

Secondary Treatment – or a secondary treatment device is treatment which results in the sedimentation of finer particulates and filtration of contaminants.

Stormwater – is the overland flow or runoff within a catchment produced by a precipitation event which flows untreated into our waterways.

Sensitive Areas – Areas that require special attention. (see Part 3 Schedules)

Stormwater Quality Improvement Device (SQID). A device which treats stormwater via primary, secondary or tertiary means. This includes, but is not limited to, devices such as litter baskets, grate and entry screens, gross pollutant traps, side entry pit traps / pit inserts, baffle pits, oil and grit separators, net devices, litter and trash racks, screens, floating litter booms, vegetated filter strips, bio retention devices, infiltration devices, on site detention systems, porous pavement, grass swales, sand filters, extended detention basins, water quality ponds, constructed wetlands.

"Sustainable Water." For the purposes of this document only a "sustainable water" outcome is an outcome from development which negates or minimizes the economic and ecological impacts of urban development on the urban water cycle. This includes those economic and ecological impacts caused by inefficient resource use, water quality impacts from the construction and post construction phases of development, and the impacts as a result of urban water cycle related infrastructure, wastewater and drainage.

Tertiary Treatment – or a tertiary treatment device is treatment which results in enhanced sedimentation and filtration, biological uptake and /or adsorption on to sediments.

Water bodies & Waterways – All clearly defined drainage lines, perennial (flowing) or intermittent (often dry) waterways, modified waterway channels, artificial channels diverting natural waterway channels, estuaries, coastal lakes or lagoons, any perennial or intermittent lakes that have a waterway running into or from them, and coastal lakes.

Water Sensitive Urban Design (WSUD) – is design which aims to promote better, more sustainable management of the total water cycle through the sensitive design of homes, streets and whole suburbs. WSUD can help counteract many of the negative impacts of urban development on the natural water cycle, such as increased flooding, accelerated sedimentation, poor water quality, inefficient resource use, and degraded aquatic systems.

1.2 ACRONYMS

The following acronyms are used throughout.

CUPDR	Committee on Uniformity of Plumbing and Drainage Regulations.
DCP	Development Control Plan.
ESD	Economically / Ecologically Sustainable Development.
EPA /DEC	Environment Protection Authority (NSW) (now Department of Environment and Conservation).
EP&A ACT	Environmental Planning and Assessment Act 1979
GPT	Gross Pollutant Trap.
LEP	Local Environment Plan
LGA	Local Government Area.
MPP	Model Planning Provision.
OSD	On Site Detention.
OSR	On site retention.
POEO Act	Protection Of the Environment Operations Act 1997
PSD	Permissible Site Discharge (PSD)
SEPP	State Environmental Planning Policy.
SMP	Stormwater Management Plan.
SSR	Site Storage Requirements.
SQID	Stormwater Quality Improvement Device.
WSUD	Water Sensitive Urban Design.

2 Site Planning Requirements

Sustainable Water residential development is designed to minimise harmful impacts on the natural water cycle and respond to natural site features. It takes advantage of nature's own water supply (rain), uses water efficiently and helps maintain the quality of water in our rivers and streams. It can reduce the life cycle costs of development.

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2.1 SITE SELECTION - BACKGROUND

Selection of a site that can accommodate the type of dwelling or building proposed is an important first step in achieving quality development. Problems associated with approval and construction often arise from a clash between the character of the site and the type of development proposed.

The location and characteristics of the land should be thoroughly considered alongside the size, shape and character of the development proposed. Some very obvious things can be overlooked. Before deciding where to place buildings, driveways and other structures you need to identify the opportunities and constraints of the site and integrate them into a 'whole site approach'. This helps ensure that the final design fits with the site's topography, climate, soils, vegetation and water.

2.2 BASIC SITE PLAN

This site plan is for individual residential dwellings, duplexes, multi unit, subdivision (<25lots) and smaller commercial and Industrial developments.

2.2.1 Basic site Plan Information.

When completing a Basic Site Plan you will need to provide illustrated detail of the development showing :-

- The boundary of the block.
- The north point.
- The location of services.
- The footprint of the development.
- The area of impermeable and permeable paved areas.
- The location of fences.
- The location of trees.
- The total hardstand area of the site i.e. the total area of roof area, garage area, concreted area and impervious paved area (footpaths, driveways, pool paved area).
- The location and direction of flow of all "sustainable water" elements (see below) and, if applicable, the location of on site septic tank and disposal areas.
- Natural features and known constraints

2.2.2 "Sustainable Water" Elements

The selection, installation and location of sustainable water devices, such as tanks and infiltration areas, must take into account the ability to access, maintain and inspect the device in its operational condition by the householder and/or regulatory authorities as applicable.

Where roofwater tanks are proposed to be installed:-

- The location of the roofwater connection,
- Size, height and type of storage.
- Overflow and connection to stormwater / other systems.
- Depth and details if to be constructed underground.

- Details of pump.
- Details of first flush system
- Details of connections to internal and external plumbing.
- Details of backflow prevention.
- Details of connection to mains if roofwater is to be internally plumbed.
- Roof area draining to rainwater tank.
- Details of mitigation measures used to reduce pump noise (if applicable).

Where infiltration and detention systems are proposed to be installed.

- Soil permeability.
- Size of system (volume).
- Overflow and connection to stormwater / other systems.
- Where OSD systems are proposed to be installed.
- Flow rate.
- Overflow and connection to stormwater / other systems.
- Location of any pre-filtering system.

Where greywater re-use system are proposed to be installed :-

- Site investigations and design details as required under AS 1547 : 2000.
- Proof of accreditation from NSW Health.
- Site plan showing site boundaries, irrigation area, relationship with street, direction of on site gradients (slope), structures and dwellings on site, paved areas.
- Details of the volumes of greywater being generated based on estimated average use.
- Details of the volume of greywater being irrigated.
- Average rainfall for the area.
- Soil permeability.
- Site layout and slopes.
- Details and schematic of the proposed greywater system including grease arrestors, upstream screens and/or filter to protect the pump and irrigation area; storage details, location and storage volume; schematic of connections to the irrigation system; irrigation area; and details of overflow connection to sewer.
- Details and locations of (as applicable) on site sewage system, disposal fields, on site detention, infiltration, or roofwater irrigation systems.
- Details of mitigation measures used to reduce pump noise (if applicable).

Where the reinstatement of riparian vegetation is proposed:-

- A landscape plan detailing the location and type of species.
- Staging plan for works.
- A maintenance and monitoring program for the first year of regeneration.

2.2.3 Cut and Fill.

If cut and fill is to be undertaken on the site, a plan must be submitted to council which shows:-

- Existing topography,
- Existing overland drainage direction (upstream and downstream).
- Location of upstream and downstream neighbouring landholders.
- Proposed volumes and location of cut and fill.
- The proposed source of the fill.
- The disposal area for the cut material.
- Proposed revised levels and topography of the site.
- The overland drainage direction following cut and/or fill (upstream and downstream).
- Description of any new overland flow impacts on neighbouring properties.
- Location, height and structural details of retaining walls.

2.3 DETAILED SITE PLAN

Detailed site planning requirements are for larger sub divisions (>25 lots), larger commercial and industrial premises (> 500m^2 increase in impermeable area).

2.3.1 General Information.

When completing a Detailed Site Plan you will need to provide illustrated detail of the development showing :-

- The boundary of the development.
- The north point.
- The location of services.
- The location of fences.
- Location of stream, creeks, dune systems, rivers as appropriate.
- Site topography.
- Site soils.
- Groundwater gradient and levels.
- Vegetation types, location and habitat connectivity.

2.3.2 Water Supply, Drainage and Wastewater Information.

Council will require a water cycle management plan which will require drawings and a technical report which will address the following details including a justification of proposed approach.

- Estimates of all water, wastewater and stormwater flows –
    - potable water supply requirements;
    - wastewater (black and grey water components);
    - roofwater volumes;
    - Strategies to improve water efficiency and reduce wastewater volumes including stormwater and wastewater re-use options.

- Industrial and commercial premises only where requested by Council:-
    - Individual itemised water consumption uses being undertaken on site eg. car wash, water for hose down, manufacturing processes, cleaning, toilets, hand washing, showers, etc.
    - An estimation of the volumes of water to be used for each itemised component.
    - An estimation of the wastewater being generated for each itemised component and the type of contaminants.
    - An evaluation of methods to improve water efficiency (apart from those standard requirements already required).
    - An evaluation of opportunities to use stormwater in place of potable water supplies for non potable uses.
    - An evaluation of opportunities to re-use some of the wastewater streams on site, such as greywater, subject to relevant quality and public safety controls.

- Stormwater flows :-
    - Pre development hydrology;- runoff volumes, frequency, peaks and flow paths;
    - Post development hydrology:- runoff volumes, frequency, peaks and flow paths;
    - A management plan which identifies measures to reduce hydrological changes including re-use and/or infiltration and/or detention plan.

2.3.3 Water Quality and WSUD Information.

A water cycle management plan is required including drawings and a technical report which will address the following details including a justification of proposed approach.

- Site and receiving water quality :-
    - Water quality of the receiving waters.
    - Water quality objectives of the receiving waters eg as defined within Healthy Rivers Commission, Catchment / Estuary / Coastal / Stormwater Management Plans, State Government Water Resource Plans or Australian Guidelines for Marine and Fresh Waters as applicable. (Council may provide these objectives).
    - Pre development modelled stormwater pollutant loads.
    - Post development modelled stormwater pollutant loads.
    - Methods proposed to treat stormwater.
- A management plan and stormwater quality modelling identifying treatment measures, using a treatment train approach, to meet water quality targets.
- The selection, installation and location of SQID and detention devices must take into account the ability to access, maintain and inspect the device in its operational condition by council, relevant regulatory authorities and/or private owner as applicable.

- SQID/s details:-
    - Pollutant to treat and its effectiveness.
    - Type/s.
    - Location.
    - Sizing and volumes.
    - Levels.
    - Direction of flow and bypass.
    - Operations and Maintenance Manual.
    - The catchment area that the SQID is treating and the optimum treatment area for the device chosen.
    - The Hydraulic regime of the SQID and the hydraulic regime of the site, including influence by tidal factors (if applicable).

- Proposed trunk drainage measures to protect natural water features as applicable.
- Proposed layout and street design measures to protect landform, natural water features and environment as applicable.
- Proposed landscape features to protect natural water features and environment as applicable.

2.3.4 Cut and Fill

The following detail is required only if Cut and Fill is undertaken.

- Existing topography,
- Existing overland drainage direction (upstream and downstream).
- Location of upstream and downstream neighbouring landholders.
- Proposed volumes and location of cut and fill.
- The proposed source of the fill.
- The disposal area for the cut material.
- Proposed revised levels and topography of the site.
- The overland drainage direction following cut and/or fill (upstream and downstream).
- Description of any new overland flow impacts on neighbouring properties.
- Location, height and structural details of retaining walls.

2.4 MASTER PLANS AND WATER CYCLE STRATEGY.

A Master Plan is a plan that specifies objectives, principles or criteria for the design and layout of development within a defined precinct or location, and may include written information, maps and diagrams. Master Plans are frequently used to guide the layout and design of new residential, commercial or industrial estates, particularly 'greenfield' sites on the urban fringe, or significant redevelopment sites in inner urban areas. In either case, master plans provide an important opportunity to ensure that the structure and configuration of new urban development supports sustainable urban water cycle outcomes.

Development patterns and layouts specified by master plans should be compatible with detailed design principles for protecting the site's land and water resources. Matters that need to be addressed include:

1. Protecting the essential hydrological and ecological functions of natural water courses, creeks, floodplains, and wetlands.
2. Using water and other landform features as key urban design elements.
3. Taking sympathetic advantage of the hydrological, ecological and recreational values offered by the site.
4. Adopting an urban structure that supports integrated water infrastructure systems and on-site stormwater management.
5. Relating other issues such as accessibility, urban structure, biodiversity conservation, flood risk management etc.

An example of the type of principles that could be incorporated in a master plan is outlined below (adapted from Donovan, Cameron and Coombes 1999). The example relates primarily to Greenfield sites on the urban fringe, but is also relevant to the rezoning of major development areas, such as former industrial sites.

<u>Design Principles for Urban Water Cycle Management</u>

1. The structure and configuration of urban development should respond and contribute positively to the hydrological and ecological functions of natural watercourses, floodplains, wetlands and native vegetation.
2. The natural drainage system should form the spine of the open space and habitat corridor system
3. The width of corridors should be determined with reference to biodiversity and flood hazard criteria.
4. The natural alignment and profile of watercouses should be retained.
5. Provision should be made for the retention and restoration of remnant native vegetation within the open space system.
6. Where possible, provision should be made for vegetated links between isolated native vegetation remnants.
7. Urban structure should respond to the topography of the site, and should enable the design of street systems that do not necessitate large-scale earth moving or modification of natural landforms.
8. Development patterns and supporting water cycle infrastructure should be consistent with and support the widespread adoption of integrated water cycle management measures.
9. Planning for flood control and water quality treatment should consider the recreational opportunities of multiple use drainage systems.
10. Planning of urban structure, accessibility and transport networks should consider the likely role of key recreational focal points in the open space and habitat corridor system.

Water Cycle Strategy

Comprehensive water cycle strategy is an investigation of hydrological issues affecting the feasibility, performance, sustainability and implementation of development, and which considers or identifies:-

1. Relevant goals for water quality, natural water balance, water efficiency, vegetation conservation, flood risk management and erosion and sediment control (these should be consistent with goals contained in water management plans, catchment blueprints, stormwater management plans, or other adopted plans or policies).
2. Design principles and management measures that are to be applied so as to meet relevant performance goals, including:
    - Proposed measures to manage site constraints and hazards such as flooding, slope stability, reactive soils, coastal hazards, erosion hazard, salinity, acid sulfate soils and land contamination.
    - Proposed measures to manage vegetation cover and dependent ecosystems such as wetlands and riparian corridors.
    - Proposed measures to manage water quality, flooding, stream flow, groundwater, soil salinity and water consumption.
3. A development strategy and infrastructure program that integrates water supply, sewerage, drainage, wastewater treatment and reuse, water quality control, flood risk management, open space provision and ecological protection issues.
4. Developer contribution arrangements.
5. A program for monitoring achievement of performance goals.
6. A maintenance schedule for stormwater source controls, with details of responsibilities and proposed enforcement mechanisms (such as covenants).
7. Proposed educational, economic and community initiatives to minimise adverse impacts on the water cycle.

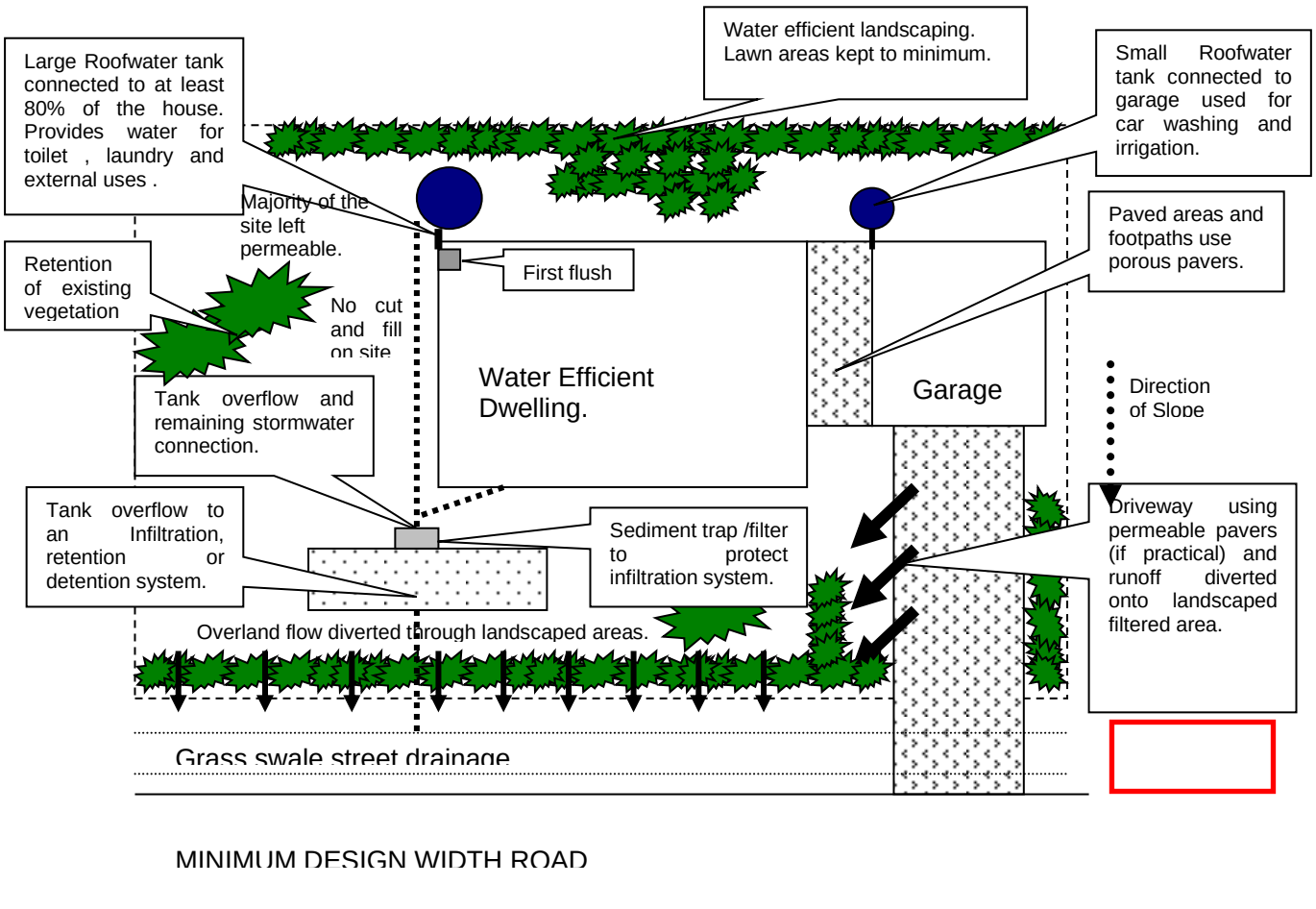
3 Residential Single Lot Development Requirements

This section outlines the Sustainable Water Requirements for residential development as described in Table 1 – Part 1 Clarence Valley Sustainable Water DCP.

The following diagram shows schematic details of possible 'sustainable water' options that can be very efficient at reducing stormwater discharge, improving stormwater quality and reducing mains water demand.[1]. A "Sustainable Water" dwelling should

- be water efficient including water efficient fixtures, and water efficient landscaping ;
- it should decrease volumes of wastewater;
- it should re-use stormwater and/or greywater for non potable uses and in a manner so as to protect human health ;
- it should treat stormwater before leaving the site ;
- it should reduce impermeable area ;
- it should retain native vegetation where possible; and
- It should retain the site topography where possible.
-

Figure 1 Example "Sustainable Water" Residential Site.[2]



[1] Note this example includes more than 12 points of options

[2] Adapted from LHCCREMS 2003.

3.1 RAINWATER TANK REQUIREMENTS

3.1.1 General Requirements.

Rainwater tanks are to be installed and designed in accordance with:-

- Manufacturer's instructions;
- Australian Standards;
- Committee in Uniformity of Plumbing and Drainage Regulations in NSW (CUPDR) "Guidelines for Plumbing Associated With Rainwater Tanks in Urban Areas (where a reticulated potable water supply is installed)."
- Water authorities requirements when a tank is to be connected to the mains water supply.

The following is a general guide as to the implementation requirements for above ground tanks however, reference should still be made to the relevant specifications and standards:

1. The rainwater tank must be designed and installed in accordance with the current CUPDR requirements applicable at the time. The combined roofwater storage must be designed to collect and store water from gutters and downpipes in accordance with relevant Australian Standards.
2. Combined roofwater storage is to be connected to the roof of the dwelling and associated sheds (eg garages) only.
3. Diversion to the roofwater storage tank/s from paved areas, driveways etc is prohibited.
4. At least a total of 80 % of the roof area of the dwelling must be diverted to roofwater storage/s or in combination with other devices with the remainder being diverted to infiltration trenches and/or on site detention before connection to the stormwater system; or directly connected to the stormwater system.
5. The first flush should be diverted to an infiltration trench or grassed buffer area before being discharged to the stormwater system.
6. The roofwater storage tank/s and fixtures (backflow prevention, pumps etc) must be corrosion/weather resistant to withstand coastal conditions in line with relevant Australian Standards.
7. The roofwater storage tank/s must fully enclose the contents with any inlet or outlet to the tank screened or filtered, to prevent the entry of foreign matter, animals or insects.
8. The roofwater tanks must provide adequate access to facilitate internal cleaning and maintenance of the tank including desludging.
9. The roofwater storage tank/s must be installed in accordance with the manufacturer's specification.
10. The roofwater storage tank stand/s must be structurally sound, in accordance with relevant Australian standards, and installed as per manufacturers specification.
11. The roofwater storage tank/s cannot be installed over any structure or fittings used by a public authority to maintain a water or sewer main.
12. No part of the roofwater storage tank/s and/or stand/s may rest on a footing of any building or other structure, including a retaining wall without written certification of adequacy by a practicing structural engineer.
13. Roofwater storage tank/s must not exceed a height of 2.4 m – Roofwater storage tank/s must be located at least 450 mm from any property boundary.
14. A sign must be attached to the rainwater tank and all rainwater taps which clearly indicates that the water in the storage/s is rainwater.

3.1.2 Underground Installation of Roofwater Storage.

The following conditions apply to the installation of underground tanks.

1. Tanks installed underground are not to be concreted, paved or otherwise built over so as to prevent access. Tanks must be accessible for maintenance, assessment and replacement if necessary.

2. The underground storage tanks are to fully enclose the contents with appropriate screens and filters provided to preclude the entry of insects or other foreign matter.
3. Access to underground storage tanks must be secured with a grate, or cover, and fastened to prevent persons untrained in confined space entry, and in particular children, from accessing them.
4. Access openings to allow access to internal fixtures (eg pumps) and inspection must be at least:-
    - 600 mm by 600 mm for storages up to 600 mm deep
    - 900 mm by 900 mm for storages greater then 600 mm deep.
5. Underground tanks will be a confined space and appropriate signposting is required. The tank may only be accessed by persons with confined space training.
6. Acid sulphate soils. The Roofwater storage should not be installed in areas of acid sulphate soils. This is due to possibility of chemical attack and subsequent failure of the storage, and exposing acidic material. Council may allow the excavation of acid sulphate material and installation of the tank within an excavated acid sulphate area if it can be demonstrated that the tank is acid and chemical resistant and/or the threat has been neutralised. Council will also require a plan detailing the neutralising and disposal of the excavated acid sulphate material.
7. Shallow groundwater zone i.e. less than 2 metres. Tanks should not be installed into the groundwater zone without the permission of council and tank buoyancy must be checked to ensure stability.
8. Corrosion resistant. Tanks installed underground may face corrosion (eg salt environment) and acidic attack (acid sulphate as described above). The tank type must be resistant to the environment in which it is placed. This applies to both above and below ground installation.
9. The tank must not be installed over or immediately adjacent to a water main, sewer main, on site wastewater system or on site wastewater disposal field.
10. The storage should not be installed adjacent to large trees or any substantial roots of large trees.
11. A roofwater storage tank used for internal purposes should not be installed underground hydraulically downstream or within 10 metres of an on site disposal field or septic tank.

3.1.3 Pump Requirements.

1. Pumps or pump systems which are used to pump water from roofwater storage for domestic purposes must be suitable for the intended use and meet the following criteria (NOTE: these requirements do not apply for pumps required for fire fighting purposes).
2. The noise from the pumps should not exceed the ambient background noise by more then 5 dB(A) measured inside any other residence. Baffles and covers for pumps or other acoustic control measures may be needed to control the noise.
3. Where electric pumps are connected to the public electricity supply system by fixed wiring, the work must be carried out in accordance with the electricity supply authority's requirements. Electric pumps chosen should be consistent with council energy efficiency policy where in place.

3.1.4 Maintenance Requirements.

1. The roofwater storage, and any first flush and backflow prevention devices must be inspected and maintained in accordance with Council, Department of Health, or public water authority conditions.
2. The roofwater storage tank/s must be maintained at all times so as not to cause a nuisance with respect to mosquito breeding or overland flow of water.
3. Any plumbing work undertaken on or for the tank that affects a water supply service pipe or a water main must be undertaken:
    a. with the consent of the public authority that has responsibility for the water supply service pipe or water main, and

b. in accordance with any requirements by the public authority for the plumbing work, and
c. by a licensed plumber in accordance with the New South Wales Code of Practice—Plumbing and Drainage produced by the Committee on Uniformity of Plumbing and Drainage Regulations in New South Wales, and accredited where required, for specific work related to the installation of rainwater tanks.

4. Council, NSW Health or the public water supply authority may inspect the installation at any time if there is a known or suspected problem with the system affecting the public water supply, other property/s or public health or during normal working hours under a periodic inspection program.

5. Should a defect in the system be found an order may be issued to rectify the defect. In the case where the defect warrants, or affects the public water supply, other property/s or public health, Council, NSW Health or the public water supply authority may rectify the defect and recover the cost from the property owner. Should an order not be complied with Council, NSW Health or the public water supply authority may rectify the defect and recover the cost from the property owner.

3.2 LOT LEVEL INFILTRATION TRENCH AND RETENTION SYSTEM REQUIREMENTS.

3.2.1 Lot level Stormwater Infiltration and Retention System Requirements.[3]

1. Where roofwater storage systems are used the overflows should be connected to the infiltration system.
2. Stormwater infiltration system includes trench, well and retention systems.
3. Stormwater Infiltration system are not to be used in the following circumstances :-
    - Areas of windblown loose sands.
    - Areas of heavy/dense clays.
    - Bedrock exposed at surface.
    - Shallow soils (< 2 metres) over rock, exposed shale, or other impermeable surface or rock formation.
    - Slopes > 5 %.
    - High water tables (depth < 1 m below surface).
    - If groundwater is known to contribute to acid sulphate leachate area.
    - Contaminated sites.
    - Areas where groundwater recharge may contribute to risk of slippage.
    - Overlying or adjacent to on site disposal fields and septic tanks.
4. A pre-filtering system must be installed upstream of the inflow into the infiltration or retention system to prevent clogging of the infiltration system. Sediment shall be removed prior to the stormwater entering the infiltration or retention system.
5. The pre-filtering system must be regularly maintained (at least every three months) by the home owner.
6. Infiltration trenches are to be located clear of:-
    - large trees.
    - stormwater flow paths.
    - vehicle pathways / driveways.
    - heavy pedestrian areas.
    - on site sewage disposal areas and septic tanks.
    - greywater irrigation areas.
    - stormwater irrigation areas.
7. The infiltration system is to be designed to accommodate the 1 in three month storm event which, for the purposes of this document, is taken as 50% of the Q1 event [4] ;

[3] Adapted from Donovan, Coombes, Cameron 1999.
[4] This is based on the work of Tweed and Gold Coast City Council.

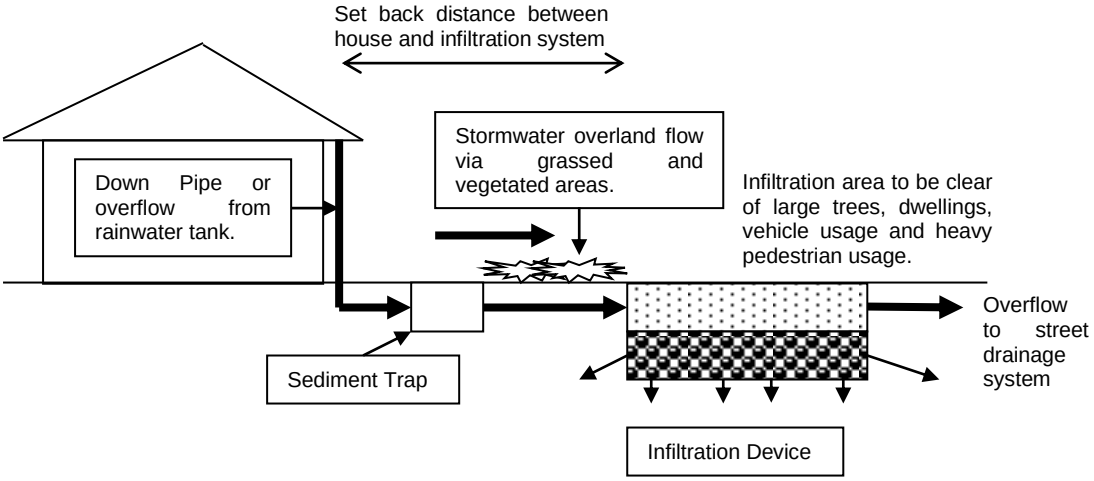
8. The infiltration system is to be of a size suitable to infiltrate the design event NB: cognisant of the onsite soil properties (specifically hydraulic conductivity).
9. Infiltration systems are to be set back from buildings, structures and property boundaries as indicated by the Soil Classification in Table 1 Setback Distances for Infiltration Systems.

Table 1 Setback Distances for Infiltration Systems.[5]

Soil Classification	Representative Soil Types	Hydraulic Conductivity	Minimum Separation between Stormwater Infiltration Trenches & Buildings
Class A Site	sand	>180mm/hr	1.5 metres
Class S Site	Silt, loam or sandy clay	180mm-36mm/hr	2 metres
Class M Site	medium clay	36mm – 3.6 mm/hr	4 metres
Class H Site	clay	3.6mm-0.036mm/hr	5 metres

Note: Soil classification is defined in Australian Standard AS 2870. When in doubt as to the soil classification at a site, reference to AS 2870 and/or an engineering assessment of the site will be required to confirm setback requirements.

Figure 2 Schematic of Infiltration Device.[6]



[5] Adapted from Cameron, Coombes and Donovan 1999.

[6] Adapted from LHCCREMS Warer Smart Fact Sheet series 2002

3.3 GREYWATER SYSTEMS.

3.3.1 General Requirements

1. Where manufactured domestic greywater treatment systems are proposed the treatment system must be accredited by the NSW Health Department [7].
2. Greywater systems must comply with AS/NZS 1547:2000 : *On-site domestic wastewater management,* "Greywater Reuse in Sewered Single Domestic Premises" NSW Health April 2000 and "On-site Sewage Management for single Households" Department of Local Government NSW January 1998 as applicable.
3. Greywater re-use is only allowed for sub surface irrigation. No other uses are permitted.
4. Where greywater re-use and stormwater re-use is proposed to be undertaken jointly on site; or onsite septic disposal and greywater/stormwater reuse is proposed to be undertaken jointly on site a water balance analysis must be undertaken to ensure that there is suitable land and usages available to accommodate disposal requirements.
5. In proposing a greywater system a site plan and report is to be prepared which contains:-
   a. Proof of accreditation from NSW Health.
   b. Site plan showing site boundaries, irrigation area, relationship with street, direction of on site gradients (slope), structures and dwellings on site, paved areas.
   c. Details of the volumes of greywater being generated based on estimated average use.
   d. Details of the volume of greywater being irrigated.
   e. Average rainfall for the area.
   f. Soil permeability.
   g. Site layout and slopes.
   h. Details and schematic of the proposed greywater system including grease arrestors, upstream screens and/or filter to protect the pump and irrigation area; storage details, location and storage volume; schematic of connections to the irrigation system; irrigation area; and details of overflow connection to sewer;
   i. Details and locations of (as applicable) on site sewage system, disposal fields, on site detention, infiltration, or roofwater irrigation systems.
6. Stormwater and greywater re-use systems are to be kept completely separate.
7. The area of sub surface irrigation is to be determined using a water balance.
8. Stormwater connections are not to be connected to the greywater system.
9. Stormwater is to be diverted around greywater storage and irrigation areas.
10. The greywater system must be sealed to prevent groundwater and rain water infiltration.
11. All lines used for greywater are to be clearly marked as being greywater and identified as being not fit for potable consumption or human contact.
12. A filter is to be placed upstream both of the pump (if used) and irrigation area to protect the pump from damage and clogging of the irrigation lines and irrigation area.
13. Water from the kitchen is to pass through a grease arrestor before entering the Greywater storage.

3.3.2 Underground Greywater Storage Requirements.

The following conditions apply to the installation of underground tanks.

1. Tanks installed underground are not to be concreted, paved or otherwise built over so as to prevent access. Tanks must be accessible for maintenance, assessment and replacement if necessary. Underground tanks will be a confined space and appropriate signposting is required. The tank may only be accessed by persons with confined space training.

[7] NSW Health " Domestic Greywater Treatment Systems Accreditation Guidelines (April 2002)."

2. Access to underground storage tanks must be secured with a grate, or cover, and fastened to prevent persons untrained in confined space entry, and in particular children, from accessing them.
3. Access openings to allow access to internal fixtures (eg pumps) and inspection must be at least:-
    - 600 mm by 600 mm for storages up to 600 mm deep
    - 900 mm by 900 mm for storages greater then 600 mm deep.
4. The underground storage tanks are to fully enclose the contents with appropriate screens and filters provided to preclude the entry of insects or other foreign matter.
5. Acid sulphate soils. The storage should not be installed in areas of acid sulphate soils. This is due to possibility of chemical attack and subsequent failure of the storage, and exposing acidic material. Council may allow the excavation of acid sulphate material and installation of the tank within an excavated acid sulphate area if it can be demonstrated that the tank is acid and chemical resistant and/or the threat has been neutralised. Council will also require a plan detailing the neutralising and disposal of the excavated acid sulphate material.
6. Shallow groundwater zone. Tanks should not be installed into the groundwater zone.
7. Corrosion resistant. Tanks installed underground may face corrosion (eg salt environment) and acidic attack (acid sulphate as described above). The tank type must be resistant to the environment in which it is placed. This applies to both above and below ground installation.
8. The tank must not be installed over or immediately adjacent to a water main, sewer main, on site wastewater system or on site wastewater disposal field.
9. The storage should not be installed adjacent to large trees or any substantial roots of large trees.

3.3.3 Pump Requirements.

1. Pumps or pump systems which are used to pump water from grey water storage for domestic purposes must be suitable for the intended use and meet the following criteria.
2. The noise from the pumps should not exceed the ambient background noise by more then 5 dB(A) measured inside any other residence. Baffles and covers for pumps or other acoustic control measures may be needed to control the noise.
3. Where electric pumps are connected to the public electricity supply system by fixed wiring, the work must be carried out in accordance with the electricity supply authority's requirements. Electric pumps chosen should be consistent with council energy efficiency policy where in place.

4 Residential, Subdivision, Multi Unit Housing, Tourist, Industrial and Commercial Development Requirements.

4.1 INTRODUCTION

This section outlines the general principles of Water Sensitive Urban Design and provides details of the requirements as described in Part One Sustainable Water DCP.

Figure 3 Examples of Sustainable Water Design Features (Residential Development).

RIGHT and BELOW The Casurina Beach development (Tweed) makes extensive use of the site naturally high infiltration properties. Broad grass swales, detention and infiltration areas are used in combination with natural vegetation landscaping and open space areas to reduce stormwater generation and treat events.

BELOW Retaining 1st and 2nd order streams, using " urban creek design" and reducing piped drainage where possible (Brisbane).

BELOW. Avoiding flow concentration by avoiding kerb. Using grass swales and bio retention filter to treat stormwater flows. (Brisbane and Grafton).

BELOW Constructed wetland, urban creek design, extensive use of grassed buffer areas, retention of vegetation, diversion of flow over landscaped areas (Brisbane).

BELOW Extensive grass filter area treating runoff from road, grass swale drainage systems and low % of impermeable area – Grafton.

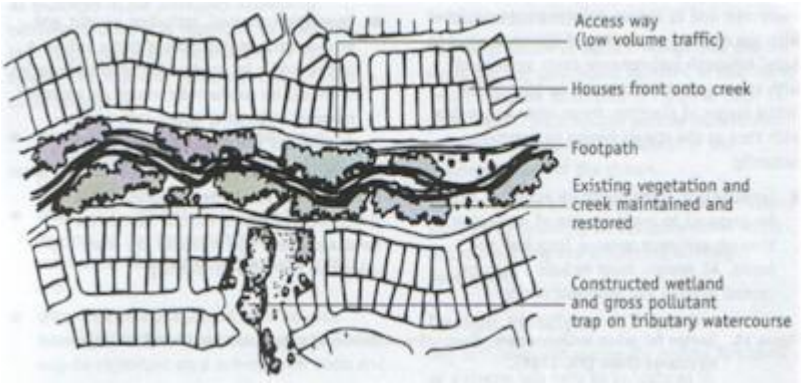
4.2 PRINCIPLES OF WATER SENSITIVE URBAN DESIGN : GENERAL REQUIREMENTS.

The diagram and photos in this section provide a diagrammatic explanation of the general principles of WSUD.

1. The trunk drainage design should be based on a system of natural watercourses and floodplains where applicable designed to mimic natural conditions and in particular natural flows as far as possible and to minimise maintenance.
2. These waterway corridors form the spine for the open space and habitat corridor system.
3. The drainage system should incorporate multiple objective open space uses where possible.
4. The width of the habitat corridors is to be based on :-
    a. the width required for flood event management.
    b. the width required for habitat connectivity (Council specified if applicable).
    c. the width required for buffer areas.
    d. the width required under DIPNR guidelines and the Rivers and Foreshores Improvement Act.
5. The natural alignment and profile of the watercourse/s is to be retained where possible.
6. Water and stormwater quality improvement devices such as detention ponds, constructed wetlands, gross pollutant traps, litter traps, sediment ponds should be placed off line to maintain the physical integrity and aesthetics of the creek system.

7. Open space planning around the trunk drainage system is to incorporate public safety with flood criteria.
8. Indigenous vegetation should be retained and rehabilitated.
9. The primary transport system should be an existing natural or designed natural style channel. Concrete channels and pipelines are to be avoided where possible.
10. Trunk drainage may account for reductions in certain storm events and pollutant transfer as a result of initiatives to reduce and treat stormwater at the lot level and through street design and layout but must allow for possible failure of the local upstream attenuation systems.
11. Stormwater outlets and discharge into bushland areas are to be fitted with energy dissipation devices and protection so as to prevent scour and erosion.
12. Where existing natural watercourses are being used to convey stormwater from a development, particular attention must be given to the low flow situation to maintain the existing moisture levels that the flora and fauna are accustomed to and dependant upon.

Figure 4 Design for Rural Residential area incorporating Habitat and Ecosystem Values (EPA,1996).



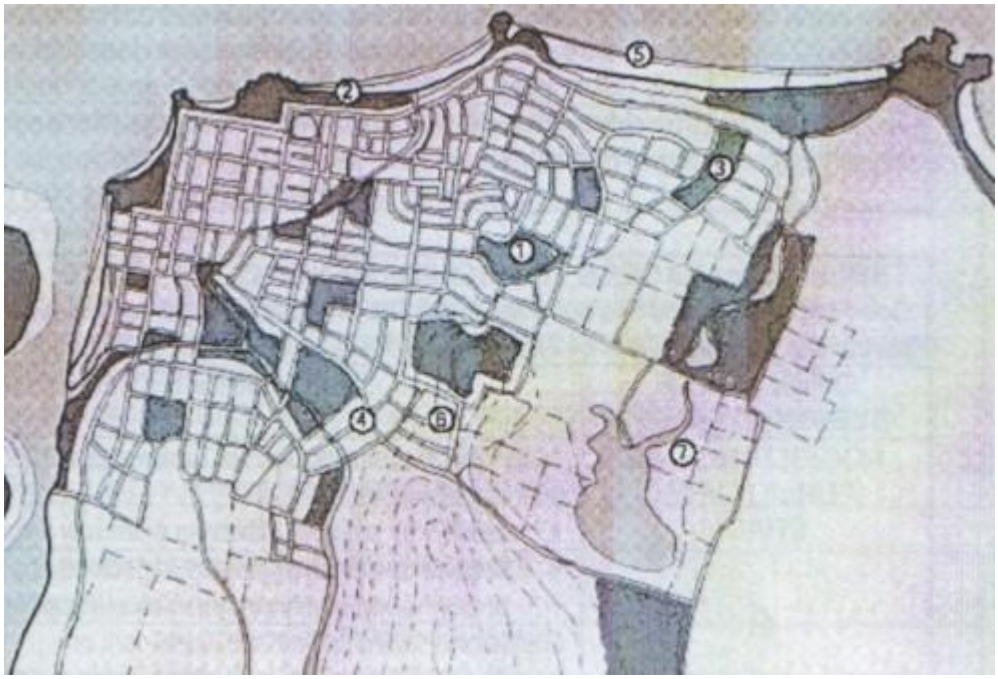


Figure 5 Undesirable Drainage Corridor / Open Space Planning[8]

The open space as pictured above does not provide (1) community recreational area (2) Environmental area buffer zones (3) Habitat connectivity and corridors (4) Retention of creek lines and associated vegetation (5) protection of dunal system from foreshore development (6) protection from future urban development for the hills behind the settlement (7) Environment setbacks around the lake and the river.

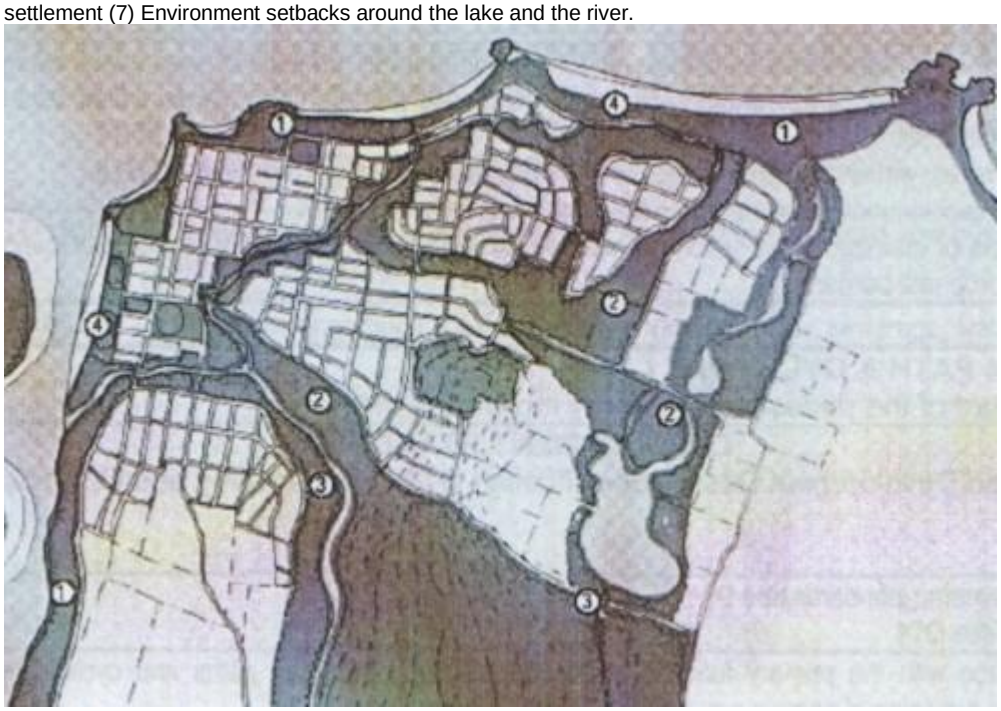


Figure 6 Desirable Drainage Corridor / Open Space Planning.

The open space provides for the protection of environmentally sensitive areas. The networks include (1) continuous forseshore access (2) wildlife corridors and habitat corridors along the creek system linking the hinterland and coastal areas (3) Riparian zones along rivers and lakes (4) Foreshore reserves along the coast.

[8] Adapted from the NSW Coastal Council Design Guidelines Discussion Paper.

4.2.1 "Urban Creek" Design Guidelines.[9]

1. Existing natural channels receiving urban drainage should be assessed for their capacity to convey the full range of flows without physical or ecological damage to the channel.
2. Stream design must be consistent with the design flood event for the system. Any modifications made to existing natural channels should be undertaken using materials, vegetation, channel form and cross section consistent with natural channels in the area.
3. Physical human access to the creek or stream should be discouraged by design eg no walkways or open grass areas placed on the banks, and using vegetation planting on the banks to discourage human intrusion. This is both for public safety and bank stability reasons.
4. Naturally functioning streams should be retained.
5. Engineered "drains" should be designed to reflect natural functions and include pool and riffle habitat areas.
6. Designed watercourse should include meandering wet, low flow channel with pools and riffles. This profile creates a diverse hydraulic conditions which aids in providing healthy habitats. Particular care needs to be given to the balance between the benefits of wet channels and the potential for the breeding of mosquitoes.
7. Channel form, shape and cross section at different sections of the stream should mimic natural stable conditions.
8. Pool and riffle system may be appropriate where[10] :-
    - Urbanised clayey soil catchment >30 ha and mild channel slope 1-5%.
    - Rural or bushland clayey soil catchment > 50 ha and mild channel slope 0.2 – 0.7 %.
9. Local catchment structure should be retained with the aggregation of sub catchment to a common discharge point avoided.
10. Stream design should consider interactions with adjacent ecosystems and habitat connectivity. These may be important on a sub regional basis and may not always correspond to water catchment boundaries.
11. All significant natural wetlands and riparian vegetation should be retained.
12. Where riparian vegetation has been removed the site should be revegetated to at least 10 m from the high bank or as otherwise recommended from site specific studies. This width should also be consistent with the appropriate flood levels.
13. Constructed wetlands and other SQID's should be placed **off line** from natural creek systems.
14. Grasses, aquatics, shrubs, and trees native to the area of works are to be used.
15. The existing natural habitat is to be assessed with critical factors (eg such as structure, connectivity, sensitivity) taken into account with any stream modification.
16. Revegetation should be undertaken progressively targeting degraded, weed infested areas first.
17. Areas with combined recreation goals should clump stands of vegetation to allow areas for walk through and open space.
18. Any channelling, lining or piping of a watercourse is to be avoided. Such practices are considered highly undesirable due to disrupting key water quality, stream bank, and ecological processes. Levelling a development area, or maximising the number of lots within a development area are not valid reasons for such impacts.
19. Construction and Maintenance must be planned to avoid erosion of waterways through sediment removal from bed and banks.
20. Vegetation removal, including aquatic and semi – aquatic plants should occur only as a last resort for eradication of weeds species.

[9] Adapted from QLD EPA "Model Stormwater Quality Management Plans and Guidelines" March 2001 and Donovan, Coombes and Cameron 1999.

[10] Taken from Brisbane City Council " Stormwater Outlets in Parks and Waterways" 2002.

21. The construction of an urban stream must be planned and staged so the system can stabilise. Constructed engineered systems will be susceptible to high flow events until vegetation is established and some natural profiling takes place.

Figure 7 Comparison of Drainage Design Philosophies.

LEFT The drain pictured has limited habitat value, no treatment value, and simply transports water and pollutants as quickly as possible to the nearby river.

BELOW LEFT The drainage system featured is a rehabilitated and reformed "urban creek" from a trapezoidal concrete drain such as the one featured above. Unlike the drain above, the "urban creek" (middle and bottom) has habitat value from the constructed pool and riffle areas; revegetated riparian vegetation and understorey; treats water quality by natural processes such as infiltration, sedimentation and biological uptake; and addresses conventional drainage issues.

BELOW. Pool and Riffle Area upstream of the urban creek (above) for low flows. The wider channel for high flows and joint use of the area for recreation is also shown.

Figure 8 Example of WSUD Drainage in Coastal situation.

BELOW The Casurina Beach development in Tweed Council makes extensive use of the sites naturally high infiltration properties to manage stormwater events. Extensive use is made of grass swales, infiltration, retention, natural vegetation and grassed areas to treat stormwater events.

Figure 9 Pool and Riffle Sequence (from Newbury and Gaboury, 1993)

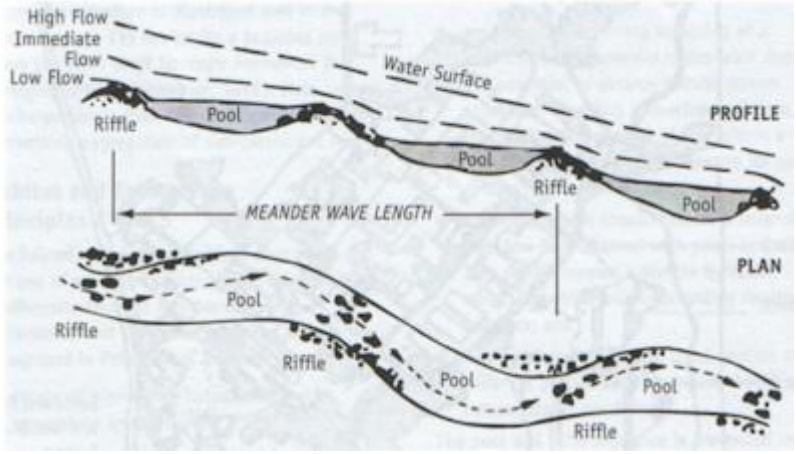
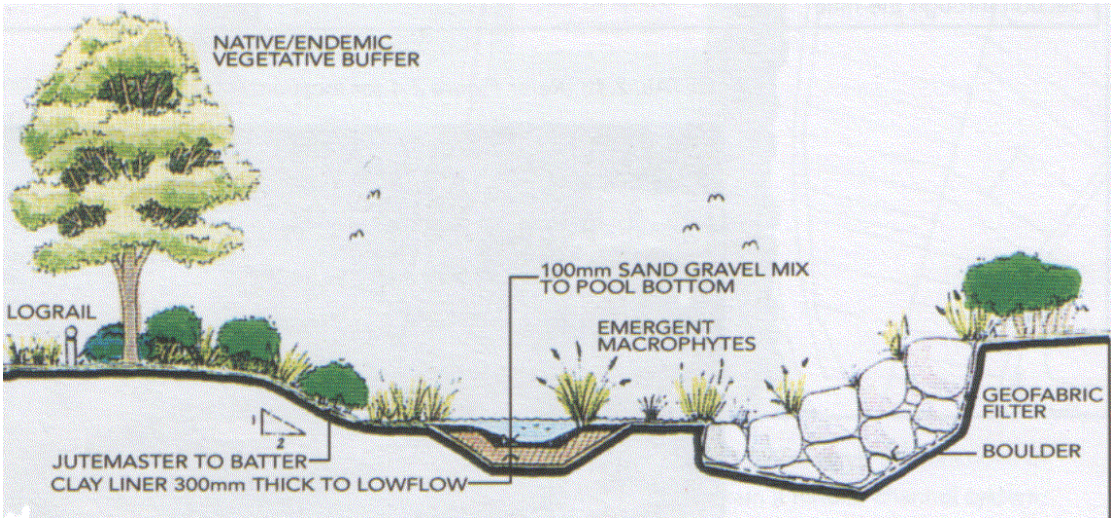
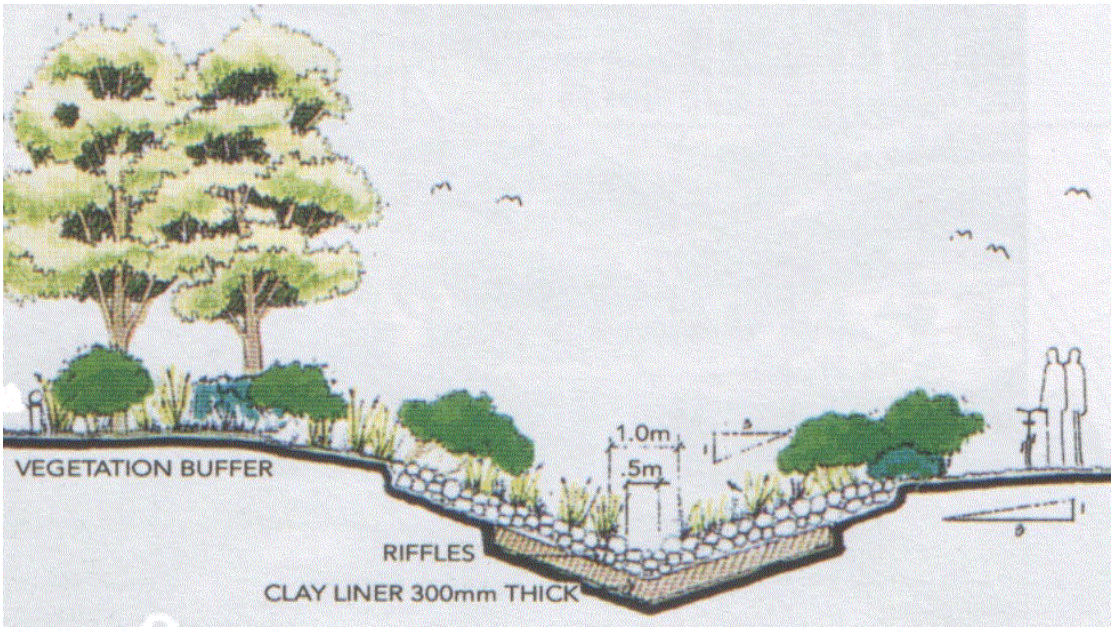


Figure 10 Example Cross Sections of Urban Creek Design used in Open Space Areas (Brisbane City Council 2002).[11]





[11] Taken from Brisbane City Council "Stormwater Outlets in Parks and Waterways" 2002.

4.3 WATER SENSITIVE STREET DESIGN AND LAYOUT

The design requirements for Water Sensitive Street Design and layout are :-

1. The design should promote the retention of the existing land form. Cut and fill is to be avoided.
2. The design and layout should retain water courses.
3. The design should minimise stormwater runoff and peaks by avoiding the channelling and concentration of flow and making use of existing site topography, natural drainage lines, soils and vegetation to treat, detain, retain and infiltrate stormwater.
4. Street layout should be designed to fit the topography so as to avoid the requirements for cut and fill.
5. Streets are not to be constructed within natural drainage lines.
6. Street design is to take into account native vegetation.
7. The street layout should avoid extended street lengths so as to reduce runoff velocities.
8. Carriageway widths should be designed to minimise the amount of impermeable area but recognising that there will be a demand for which must be addressed either within the properties or on street.
9. Street design is to take into account the cleansing of stormwater through the use of landscaping, grass swales, filter strips, infiltration pits and oil/grit separators.
10. The design of the road cross section is to take into account the major stormwater runoff events whilst allowing for vehicle safety.
11. The piped drainage scheme is to take into account possible decrease flows as a result of the adoption of “sustainable water” measures within individual lots onsite.

Figure 11 Comparison of Street Design Layout Design.

ABOVE The photo above shows a conventional sub division development. The site has had all vegetation removed, has been levelled and filled, made impermeable with wide width roads, driveways and roofs, and has water channelled to a conventional kerb and gutter system. Individual lots offer no stormwater treatment or water efficient measures.

BELOW WSUD development in Brisbane. Key vegetation has been retained with the roads following contours of the site. No fill has been undertaken used. Small width roads have been used in recognition this is a low traffic area. No kerb and gutter has been used so that the channelisation and concentration of flow is avoided. Grass swales have been used to infiltrate and treat stormwater events. The level of impervious area has been minimised. Stormwater on each individual lot is treated by capturing and re-using stormwater in rainwater tanks and using on site infiltration systems for overflow. All houses are water and energy efficient.

4.4 WATER SENSITIVE LANDSCAPING DESIGN GUIDELINES

Landscaping is to be designed to retain, restore or rehabilitate the natural landscape.

1. Landscaping is to provide habitat for indigenous species including the provision of fauna habitat measures such as ponds, wetlands, shrubs, hollowed tree's, nest and roost boxes
2. Landscaping is to be water efficient and ideally use stormwater or greywater for irrigation.
3. Landscaping is to be designed so as to minimise the needs for nutrients and herbicides.
4. The natural topography should be retained with cut, fill and infill avoided where possible.
5. Watercourses and other water features are to be retained or rehabilitated if required.
6. Degraded riparian areas are to be revegetated to at least 10 m from the top of the bank (bank means the limit of the bed of any river as defined in the Soil Conservation Act 1938).
7. Riparian, dunal and other vegetation is to be retained in buffer areas.
8. Vegetation retention should be planned along creeks, drainage lines, 1st and 2nd order streams, and habitat corridors.
9. Vegetation retention should include both the upper and understorey layer.
10. Grassed area should be planted with indigenous grasses to reduce or eliminate mowing and watering.
11. Areas which require a high water demand are to use a water efficient water irrigation system and ideally be irrigated with non potable water supplies such as roofwater.
12. Landscaping should be designed to promote the slow down, detain, capture and infiltrate stormwater though the use of depressions, swales, sedges, reed beds or similar.
13. Stormwater outlets and discharge into landscaped areas are to be fitted with energy dissipation devices and protection so as to prevent scour and erosion.
14. SQIDs in landscaped areas are to be designed to fit in with the aesthetics of the site.
15. Where possible, weed control should be managed with the use of mulch.

5 Stormwater Quality Requirements.

5.1 WATER QUALITY TAREGTS FOR NEW DEVELOPMENT

Table 2 Default Water Quality Targets

WATER QUALITY PARAMETER	DEFAULT TARGET
Gross Pollutants	90% of average annual load retained
Total Phosphorus (TP)	60% of average annual load retained
Total Nitrogen (TN)	45% of average annual load retained
Total Suspended Solids (TSS)	85% of average annual load retained

Table 3 Example "Deemed to Comply Solutions (Tourist, Industrial and Commercial Development) up to 2 ha" based on the water quality targets for Industrial and Commercial premises

Parameter	Deemed to Comply Options[12]		
	Development up to 500 m2	Development 500 m2 to 1 ha	Development 1 ha to 2 ha
General	Water Sensitive Urban Design in street, layout, trunk drainage and road landscaping to reduce runoff volumes, velocities and contaminant loading.		
Gross Pollutants (> 5 mm)	**General Requirements (all industrial, commercial premises).** Primary devices. ▪ Litter baskets. ▪ Side entry pit traps. ▪ Kerb inlet protectors. ▪ Catch basins (modified wet sump gully pits). ▪ Gross Pollutant Traps. ▪ On Site Detention Systems.	**General Requirements (all industrial, commercial premises).** Primary devices. ▪ Litter baskets. ▪ Side entry pit traps. ▪ Kerb inlet protectors. ▪ Catch basins (modified wet sump gully pits). ▪ Gross Pollutant Traps.	**General Requirements (all industrial, commercial premises).** Primary devices. ▪ Litter baskets, catch basins, side entry pit traps used in combination with another Gross Pollutant Device/s. ▪ Kerb inlet protectors. ▪ Gross Pollutant Traps.
	Additional requirements for Specific industrial/ commercial. Nurseries – as above. Service stations – as above Fast food outlets – as above. Car Yards – as above. Depot – as above Metal workshop – as above Abattoirs – as above.	**Additional requirements for Specific industrial/ commercial.** Nurseries – as above. Service stations – as above Fast food outlets – as above. Car Yards – as above. Depot – as above Metal workshop – as above Abattoirs – as above.	**Additional requirements for Specific industrial/commercial.** Nurseries – as above. Service stations – as above Fast food outlets – as above. Car Yards – as above. Depot – as above Metal workshop – as above Abattoirs – as above.
Coarse Sediment (0.5 – 5 mm) Medium Sediment (0.05 – 0.5 mm) Fine Sediment (> 0.05 mm)	**General Requirements (all industrial, commercial premises).** Either a primary or secondary treatment option can be implemented. Primary Treatment Options. ▪ On Site Detention. ▪ Sediment traps. ▪ Kerb inlet protectors. ▪ Catch basins (modified wet sump gully pit). ▪ Side entry pit traps/pit inserts. ▪ GPT's which offer some fine sediment removal. Secondary Treatment Options. ▪ Grass Swales. ▪ Vegetated filter strips. ▪ Infiltration systems with upstream sediment traps. ▪ Porous pavers with upstream sediment traps. ▪ Sand filters with upstream sediment traps.	**General Requirements (all industrial, commercial premises).** Either a primary or secondary treatment option can be implemented. Primary Treatment Options. ▪ On Site Detention, catch basins, kerb inlet protectors and side entry pits **when used in combination with secondary treatment options.** ▪ Sediment traps. ▪ GPT's which offer some fine sediment removal. Secondary Treatment Options. ▪ Grass Swales. ▪ Vegetated filter strips. ▪ Infiltration systems with upstream sediment traps. ▪ Porous pavers with upstream sediment traps. ▪ Sand filters with upstream sediment traps.	**General Requirements (all industrial, commercial premises).** Both primary and tertiary treatment option/s must be implemented. Primary Treatment Options. ▪ On Site Detention. ▪ Sediment traps. ▪ Kerb inlet protectors. ▪ Catch basins (modified wet sump gully pit). ▪ Side entry pit traps/pit inserts. ▪ GPT's which offer some fine sediment removal. Secondary Treatment Options. ▪ Grass Swales. ▪ Vegetated filter strips. ▪ Infiltration systems with upstream sediment traps. ▪ Porous pavers with upstream sediment traps. Sand filters with upstream sediment traps.

[12] These are based on the water quality objectives and a literature review of the performance of systems for the associated catchment area.

Parameter	Deemed to Comply Options[12]		
	Development up to 500 m2	Development 500 m2 to 1 ha	Development 1 ha to 2 ha
	Additional requirements for Specific industrial/ commercial. Nurseries – as above. Service stations – as above Fast food outlets – as above. Car Yards – as above. Depot – as above Metal workshop – as above Abattoirs – as above.	**Additional requirements for Specific industrial/ commercial.** Nurseries – as above. Service stations – as above Fast food outlets – as above. Car Yards – as above. Depot – as above Metal workshop – as above Abattoirs – primary and secondary options must be employed. Agricultural Sales yard – primary and secondary options must be employed	**Additional requirements for Specific industrial/ commercial.** Nurseries – as above. Service stations – as above Fast food outlets – as above. Car Yards – as above. Depot – as above Metal workshop – as above Abattoirs – as above Agricultural Sales yard – as above.
Nutrients (Total Nitrogen and Total Phosphorous).	**General Requirements (all industrial, commercial premises).** Not required at this scale of development.	**General Requirements (all industrial, commercial premises).** Not required at this scale of development.	**General Requirements (all industrial, commercial premises).** Secondary Treatment Option/s. ▪ Grass Swales. ▪ Vegetated filter strips. ▪ Infiltration systems with upstream sediment traps. ▪ Porous pavers with upstream sediment traps. ▪ Sand filters with upstream sediment traps.
	Additional requirements for Specific industrial/ commercial. Nurseries – as above. Service stations – as above Fast food outlets – as above. Car Yards – as above. Depot – as above Metal workshop – as above Abattoirs – as above	**Additional requirements for Specific industrial/ commercial.** Nurseries – secondary treatment options must be implemented with an upstream device to remove coarse and medium sediments. Service stations – as above Fast food outlets – as above. Car Yards – as above. Depot – as above Metal workshop – as above Abattoirs – secondary treatment options must be implemented with upstream removal of coarse and medium sediment. Agricultural Sales yard – secondary treatment options must be implemented with upstream removal of coarse and medium sediment.	**Additional requirements for Specific industrial/ commercial.** Nurseries – as above. Service stations – as above Fast food outlets – as above. Car Yards – as above. Depot – as above Metal workshop – as above Abattoirs – as above Agricultural Sales yard – as above.
Heavy Metals.	**General Requirements (all industrial, commercial premises).** Not required at this scale of development.	**General Requirements (all industrial, commercial premises).** Either a primary or secondary treatment device can be used. Primary Treatment Options. ▪ Oil and grit separators. Secondary Treatment options. ▪ Grass Swales. ▪ Vegetated filter strips. ▪ Infiltration systems with upstream sediment traps. ▪ Sand filters with upstream sediment traps. ▪ Porous Pavers with upstream sediment traps.	**General Requirements (all industrial, commercial premises).** Both a primary and secondary treatment option/s must be implemented. Primary Treatment Options. ▪ Oil and grit separators. Secondary Treatment options. ▪ Grass Swales. ▪ Vegetated filter strips. ▪ Infiltration systems with upstream sediment traps. ▪ Sand filters with upstream sediment traps. Porous Pavers with upstream sediment traps.

Parameter	Deemed to Comply Options[12]		
	Development up to 500 m2	Development 500 m2 to 1 ha	Development 1 ha to 2 ha
	Additional requirements for Specific industrial/ commercial. .Nurseries – as above. Service stations – a primary device must be implemented Fast food outlets – as above. Car Yards – a primary device must be implemented. Depot – a primary device may be required to be implemented if requested by council (eg high risk activity, not enough attention to source control). Metal workshop – a primary device may be required to be implemented if requested by council (eg high risk activity, not enough attention to source control). Abattoirs -	**Additional requirements for Specific industrial/ commercial.** Nurseries – not required expect for hard surface car park areas.. Service stations – as above Fast food outlets – as above. Car Yards – as above. Depot – as above Metal workshop – as above Abattoirs – not required except for car park areas. Agricultural Sales yard – not required expect for hard surface car park areas.	**Additional requirements for Specific industrial/ commercial.** Nurseries – not required expect for hard surface car park areas.. Service stations – as above Fast food outlets – as above. Car Yards – as above. Depot – as above Metal workshop – as above Abattoirs – not required except for car park areas. Agricultural Sales yard – not required expect for hard surface car park areas.

5.2 WATER QUALITY TARGETS FOR CAR PARK AREAS.

Table 4 "Targets and Example Deemed to Comply Stormwater Treatment Measures for Carparks"

Requirement	**Car Park Size.**		
	< 5 spaces	**5 – 20 or equivalent area car spaces**	**20 + or equivalent areas car spaces.**
Gross Pollutants + litter	No target for this scale of development.	30 % of average annual load retained.	50 % of average annual load retained.
	No requirements.	Primary devices. ▪ Litter baskets. ▪ Side entry pit traps. ▪ Kerb inlet protectors. ▪ Catch basins (modified wet sump gully pits). ▪ Gross Pollutant Traps.	Primary devices. ▪ Litter baskets, catch basins, side entry pit traps used in combination with another Gross Pollutant Device/s. ▪ Kerb inlet protectors. ▪ Gross Pollutant Traps.
Hydrocarbons.	No target for this scale of development.	30 % of average annual load retained.	50 % of average annual load retained.
	No requirements.	Either a primary or secondary treatment device can be used. Primary Treatment Options. ▪ Oil and grit separators. Secondary Treatment options. ▪ Grass Swales. ▪ Vegetated filter strips. ▪ Infiltration systems with upstream sediment traps. ▪ Sand filters with upstream sediment traps. ▪ Porous Pavers with upstream sediment traps.	Both a primary and secondary treatment option must be implemented. Primary Treatment Options. ▪ Oil and grit separators. Secondary Treatment options. ▪ Grass Swales. ▪ Vegetated filter strips. ▪ Infiltration systems with upstream sediment traps. ▪ Sand filters with upstream sediment traps. Porous Pavers with upstream sediment traps.
Heavy Metals.	No target for this scale of development.	30 % of average annual pollutant load retained.	50 % of average annual load retained.
	No requirements.	Either a primary or secondary treatment device can be used. Primary Treatment Options. ▪ Oil and Grit separators. ▪ Side entry pit traps equipped with oil socks. ▪ Certain GPT's equipped with baffles and or oils socks. ▪ Sediment traps. Secondary Treatment Options. ▪ Grass Swales. ▪ Vegetated filter strips. ▪ Infiltration systems with upstream sediment traps. ▪ Porous pavers with upstream sediment traps. ▪ Sand filters with upstream sediment traps.	A primary and secondary treatment device must be implemented. Primary Treatment Options. ▪ Oil and Grit separators. ▪ Side entry pit traps equipped with oil socks. ▪ Certain GPT's equipped with baffles and or oils socks. ▪ Sediment traps. Secondary Treatment Options. ▪ Grass Swales. ▪ Vegetated filter strips. ▪ Infiltration systems with upstream sediment traps. ▪ Porous pavers with upstream sediment traps. ▪ Sand filters with upstream sediment traps.

6 Stormwater Quality Improvement Devices

6.1.1 SQID Design Manuals.

The following design manuals are recommended in the absence of a suitable AUS SPEC design specification.

1. The Institute of Engineers Australia “Australian Runoff Quality” 4th Edition and subsequent updates.
2. Austroads AP R232 “Guidelines for Treatment of Stormwater Runoff from Road Infrastructure“ and subsequent updates.
3. New South Wales Environmental Protection Authority Managing Urban Stormwater: Treatment Techniques and subsequent updates.
4. Upper Parramatta River Catchment Trust (2003) Water Sensitive Urban Design Technical Guidelines for Western Sydney and subsequent updates.
5. NSW Department of Land and Water Conservation Constructed Wetlands Design Manual 1998 and subsequent updates.
6. Brisbane City Council “Stormwater Outlets in Parks and Waterways” Guidelines 2002 and subsequent updates.
7. Brisbane City Council “Sediment Basin Design, Construction and Maintenance” Guidelines January 2001 and subsequent updates.
8. Brisbane City Council “”Natural Channel Design Guidelines” and subsequent updates.
9. NSW Department of Housing and Department of Land and Water Conservation publication “Managing Urban Stormwater: Soils and Construction“ and subsequent updates.
10. “Soil and Sediment Control - Engineering Guidelines for Queensland Construction Sites 1996” The Institute of Engineers, Australia, Queensland Division.

6.1.2 System Sizing.

Systems, except where noted otherwise, are to be designed for the 1 in 3 month storm event unless noted otherwise. For the purposes of this document this event is defined as 50% of the Q1 year event.
Appropriate rainfall data must be obtained for the area in which the development is proposed.

6.1.3 SQID Systems

Systems are to be preferably “dry” systems (i.e. they drain dry and the pollutants trapped within are not stored in liquid) wherever possible. Wet sump systems are not preferred due to increased disposal and waste management costs.

7 Operations and Maintenance Manual Requirements.

An Operations and Maintenance manual is required for each stormwater treatment measure (STM) and the manual must contain:-

a. Worksafe procedures (Occupational Health and Safety) for the safe operation and maintenance of the SQID.
b. Supplier contact for parts, services and / or technical advice.
c. The mechanism required to clean the device (eg manual removal, backhoe, eductor truck) etc.
d. Any consumables required for the maintenance of the device.
e. Maintenance and Inspection forms which clearly identifies the data collection requirements.
f. A specified maintenance frequency eg either in terms of maintenance on a specific events basis, a periodic basis, or based on certain levels of material trapped within the device. NOTE: The statement “Maintain as required “is not acceptable.
g. Dewatering and waste disposal procedures. This includes the names and locations of licensed operators able to take the waste. Any and all regulated, hazardous or other waste licensing requirements which must be followed in the transportation and disposal of the liquid and dry waste components.
h. Access points for vehicles / machinery as required.
i. An estimate of costs for maintenance incorporating the likely frequency of cleanout, type of cleanout, the costs for transport, vehicle hire (eg Eductor truck if required), disposal and consumables.
j. A schematic of the SQID, its connections to the drainage system, and description of operations.
k. Full schematic and as constructed electrical diagrams for any and all electrical and electronic components.
l. Inspection and monitoring frequency including the type of monitoring and data collection required to assess the performance of the system.
m. The type of material likely to be caught in the device (eg liquid or solid).
n. A replacement cost for the asset.
o. Stakeholder notification requirements when undertaking maintenance.
p. Any other information necessary for the management, operation and maintenance of the SQID.

7.1 PRIVATE SQID REQUIREMENTS.

Where a SQID remains the property of a private operation the following additional requirements apply.

1. The operator of the SQID will be required to submit to council annual returns and a fee for the licensing of the SQID.
2. The material collected from the SQID will need to be classified in accordance with the requirements of the Department of Environment and Conservation (Environment Protection Authority of NSW) and disposed of in accordance with the requirements.
3. The annual returns will consist of :-
    a. The name of the operator of the device.
    b. The type/model and location of the device.
    c. The date/s maintenance was undertaken.
    d. The classification of the material in accordance with the requirements of the Department of Environment and Conservation
    e. The name of the person/company who undertook the disposal/s of the material.
    f. The name and location of the waste disposal site/s.
    g. An estimation on the volumes of material removed.

h. A copy of the receipt for the disposal/s from the waste receival facility
i. A description an estimated percentage of breakdown of the material disposed (eg wet liquid, dry material, predominately leaf litter and sand, predominately fast food waste etc).
j. Details of any amendments to the device (if applicable) and the reason for amendments.
k. Updated Operations and Maintenance manuals (if applicable).

7.2 REQUIREMENTS FOR SPECIFIC SQIDS.

These requirements should be added to those already indicated and apply to specific SQIDs.

7.2.1 Grass Swales.

Grass swales together with the road corridor are to be designed in accordance with the design event for the drainage system to offer property protection (eg 20, 50 or 100 year ARI depending on the site).

1. Grass swales should generally not be built in the following conditions:-
   - On slopes which exceed 5 %[13].
   - On soils with a high clay content subject to heavy compaction[14].
   - Areas likely to be exposed to heavy off street parking.[15]
2. Where grass swales are proposed to be constructed on areas with slopes greater then 5 % then the proponent must provide details of how erosion risk to the swales will be managed and details of construction staging requirements to reduce erosion risk whilst the swale is unvegetated.
3. Grass Swales may be built in areas less then 1 % slope if an extended duration of water pondage is unlikely to occur. This includes areas which are highly permeable; or measures are taken to improve sub surface drainage.
4. Grass swales constructed in areas with slopes less then 1% should install sub soil drains or wetland plants to reduce ponding if site conditions are not favourable for infiltration. The potential for mosquito breeding must be minimised.
5. Grass swales should be trapezoidal or parabolic in design to maximise contact. "V" shaped channels are not to be implemented.
6. Swales should be a long shallow linear depression with low sloping sides (preferably 1 in 8, maximum 1 in 5 slope).[16]
7. Grass swales need to be designed for minimal maintenance, particularly where subject to Council responsibility. The street scape should be designed so that the grass swales generally form the property frontage such that the property owners will normally undertake the grass maintenance similar to any footpath area.
8. Vegetation or other means should be used to discourage the use of the swales for off street parking.

7.2.2 Gross Pollutant and Litter Trap Requirements.

1. Gross Pollutant and litter traps should be "dry" systems i.e. wet sump devices which store contaminants within a wet ponded sump are not preferred.
2. Gross Pollutant and litter traps are to be placed off line in the major drainage systems so that should the system block it will not cause upstream flooding and/or an adequate bypass is provided.
3. Under no circumstances are GPT's to be used in place of oil and grit separators unless appropriate baffles and /or oil sock are provided.
4. GPT's and litter traps must be suitable for the hydraulic head conditions, including any tidal influence it is operating in.
5. Proprietary GPT's must be modified as requested by councils Operations & Maintenance section if requested for OH&S reasons. Where these modifications would impact on the performance of the proprietary GPT then another unit must be chosen which can accommodate both treatment and OH&S criteria. Developers are advised to consult with Council regarding their choice of devices.

7.2.3 Oil/Grit Separators.

a. Oil and Grit Separators are not to be used as Gross Pollutant traps or sediment traps.

[13] Increased erosion potential of the swale.

[14] Reduced infiltration.

[15] Will disturb grass cover and compact the swale resulting in reduced infiltration.

[16] Based on Brisbane City Council Guidelines.

7.2.4 Constructed Wetlands and Treatment Ponds.

1. Wetlands are to be designed generally in accordance with the "NSW Constructed Wetlands Manual" with the design to be completed by a qualified professional with specific experience in this area.
2. Developers are advised to consult with Council regarding the experience of the proposed designer.
3. A sediment control pond/bay is to be constructed upstream of the main constructed wetlands. Convenient access for maintenance is essential.
4. A bypass or overflow is to be provided which protects the constructed wetlands/pond from high flow events beyond its design capacity. The spillway or overflow of treatment ponds and wetlands is to be rock armoured or other to prevent scour in bypass/overflow events.
5. Constructed wetlands and treatment ponds are to be placed off line where possible.
6. The slopes adjacent to the water surface and under water of constructed wetlands and ponds are to be battered at a maximum slope of 1:8[17] to assist with exiting the wetland. If slopes are steeper then 1:8 then the section of wetland/pond adjacent to the slope is to be fenced off with a childproof fence or other suitable barrier.
7. The edges of the wetland should be planted with species of plants and at a density to discourage entry into the water of the wetland particularly by children.
8. Species for wetlands are preferred from local vegetation listings.
9. Ponds and wetlands are to be designed so as to account for Mosquito management by design.
10. Land must be retained around the pond to allow councils to dewater, dry and stockpile silt and vegetation material before disposal.
11. Species selection needs to incorporate the salt tolerance required.

7.2.5 Infiltration Basins.

1. All infiltration basins are to be protected by an upstream sediment pond or filter strip to remove fines which may affect the permeability of the infiltration area.
2. All infiltration basins are to be marked, fenced, vegetated or other so as to keep vehicles and heavy pedestrian access off them.
3. Infiltration basins are not to be constructed in areas where clay content exceeds 30 %.
4. Infiltration basins are not to be constructed in areas with high water tables.
5. Infiltration basins are not to be constructed on areas with compacted fill material.

7.2.6 SQID Selection Guidance Advice.

The following tables provide some guidance for the choice of SQID based on the water quality objectives to be achieved and the catchment area being treated. The information comes from a range of sources including

- NSW EPA Draft Treatment Techniques (1997),
- Blacktown City Council Stormwater Quality Control Policy – Background Information and Guidelines for Application.
- Brisbane City Council Water Quality Management Guidelines Version 1 2000.
- Gold Coast City Council Stormwater Treatment Device, Design and Selection Guidelines June 2002.
- Lake Macquarie Council Draft Stormwater Treatment Framework & Stormwater Quality Improvement Device Guidelines.

NOTE: These are broad guidelines only. Detailed consideration should be given to site constraints, operating conditions and the latest technical guidelines and findings when selecting a SQID.

[17] Based on Camden guidelines. *SUZANNE - Which guidelines?*

8 On Site Detention

8.1 ON SITE DETENTION

This section is for individual dwellings, multi unit development, and smaller tourism, commercial and industrial areas.

8.1.1 General Requirements.[18]

1. All OSD must be fitted with an overflow which drains to the street drainage system and designed to overflow the 1 in 100 year event.
2. For residential dwellings at least a total of 80% of the roof area of the dwelling must be diverted either to the OSD device or a combination of devices.
3. The OSD device shall be located within the dwelling lot.

8.1.2 Acceptable Types of OSD.

OSD may be in the form of

- Above ground grassed or landscaped area;
- Above ground shallow pond on a driveway;
- Below ground storage tank;
- Roofwater storage tank connected to at least 80% of the roof area;
- Combinations of the above as long as at least 80% of the roof area of the house is diverted to the OSD devices/s.

8.1.3 Discharge Control Pit and Signage Requirements.

1. Orifice plates are to be corrosion resistant 3 mm stainless steel. Where the orifice exceeds 150 mm the material is to be 5 mm thick.
2. The outlet opening is to be designed so as to avoid the likelihood of being blocked by debris.
3. The Discharge Control Pit is to be fitted with an internal screen to protect the orifice from blockage.
4. Each on site detention system is to be marked by a plate in a prominent position which states "This is an on site detention system. It is an offence to reduce the volume of the tank or basin or interfere with the orifice plate that controls the outflow. The base of the outflow control pit and the debris screen must be cleaned of debris and sediment on a regular basis by the owner. "[19]

8.1.4 Underground OSD and Access Requirements.

1. Tanks installed underground are not to be concreted, paved or otherwise built over so as to prevent access. Tanks must be accessible for maintenance, assessment and replacement if necessary. Underground tanks will be a confined space and appropriate signposting is required. The tank may only be accessed by persons with confined space training.
2. Access to underground storage tanks must be secured with a grate, or cover, and fastened to prevent persons untrained in confined space entry, and in particular children, from accessing them..
3. Access openings must be at least:-
   - 600 mm by 600 mm for storages up to 600 mm deep
   - 900 mm by 900 mm for storages greater then 600 mm deep.
4. The floor of the storage must be graded so that the storage empties and water does not pool with the tank.

[18] This section is based both on Wollongong and Ryde Council OSD policy.

[19] Wording take from Ryde Council example.

5. Corrosion resistant. Tanks installed underground may face corrosion (eg salt environment) and acidic attack). The tank type must be resistant to the environment in which it is placed. This applies to both above and below ground installation.
6. The tank must not be installed over or immediately adjacent to a water main, sewer main, on site wastewater system or on site wastewater disposal field.
7. The storage should not be installed adjacent to large tree's or the roots of large tree's.
8. OSD storage should generally not be installed into the groundwater zone if possible without the permission of council.

8.1.5 Combined Roofwater and OSD systems.

1. On site detention in the form of roofwater storage systems is encouraged to promote the harvesting of stormwater along with OSD.
2. Where on site detention is in the form of a roofwater storage, wholly or in part, at least 80 % of the roof area must be connected to the storage/s. (Refer to Section 3.1)

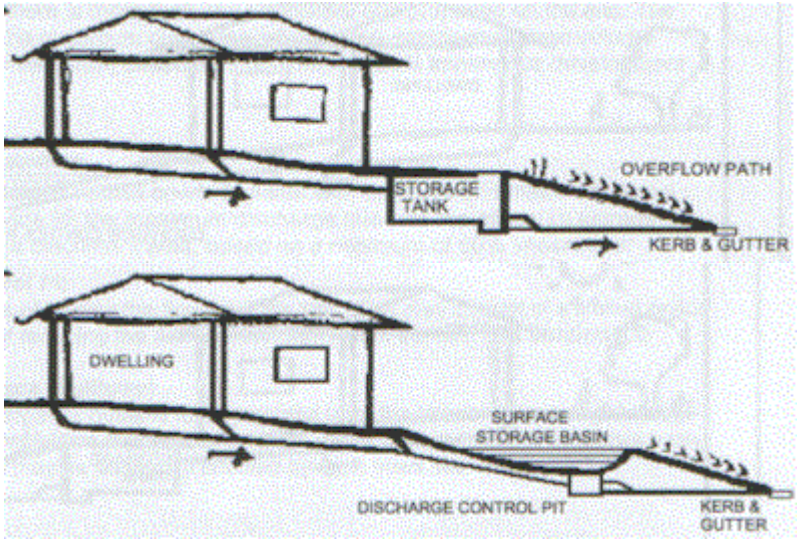
8.1.6 Above Ground Storage and Paved Surface OSD.

1. The floor of the storage must be graded so that the storage empties and water does not pool.
2. Water ponding depth is to be limited to a depth of 150 mm in areas where vehicles are parked.
3. Depth is limited to 180 mm in areas where vehicles are not parked.
4. The storage area should be totally impermeable.

8.1.7 Landscaped OSD.

1. Landscaped OSD cannot be undertaken across lot boundaries.
2. Landscaped OSD cannot be deeper than
   - 300 mm if stepped.
   - 1200 mm if with a slope of less than 1 in 8.
   - 1200 mm if with a slope greater than 1 in 8 and surrounded by a childproof fence.
3. The floor of the OSD area is to be permeable to allow infiltration.
4. The bunded wall of the landscaped OSD area must be impermeable.

Figure 12 Example of Underground and Landscaped OSD (Ryde 2001)[20].



[20] Taken from Ryde Council " Stormwater Management DCP" 14/08/2001.

8.2 DETENTION (OTHER THAN ON SITE).

This section refers to detention at the larger tourism development, industrial, commercial and sub division scale.

8.2.1 General Requirements.

1. The design of engineered detention systems shall form part of the hydrologic/hydraulic design of the drainage system. Design parameters and performance data needs to be provided.
2. The use of natural and existing detention offered by natural drainage corridors is encouraged over engineered detention solutions.
3. Engineered detention systems are not to be placed over natural water bodies.
4. Detention areas should be dual purpose where possible making use of existing open space and storage opportunities.
5. Where detention is to be undertaken as part of a dual purpose the following maximum ponded water depths are not to be exceeded.

Table 5 Maximum Ponding Depths for Detention[21]

Area	Maximum Ponding depth (mm)
Car Parking Area	150 mm
Paved Area (other then Carpark)	200 mm
Landscaped Areas	600 mm
Sports Field	600 mm Factors such as drying time for the sports field in question should also be taken into consideration.
Area enclosed by a childproof fence or otherwise not accessible.	No limit
Roof Area	As based on structural integrity and safety factors.

8.2.2 Detention Plan Requirements.

1. Where a detention plan is required to be submitted it is to contain the following at minimum: -
    - Estimation of the volume of OSD storage required. This estimate should take into account the impacts of infiltration or other systems used by the proposed development to reduce stormwater events and volumes.
    - Calculations of the maximum 100 year ARI flow rate for flow paths and floodways.
    - Details of the layout and location of all detention basins.
    - Details of the proposed multiple use of detention basins.
    - Details of the depths of detention basins under design flow events.
    - Details of overflow pathways.
    - Location of all discharge points and discharge flows.
    - Cross sections and design of all systems.
    - A maintenance plan detailing maintenance requirements of all detention systems.
    - Contours and spot levels.

[21] Based on examples from Wollongong and Ryde Councils. Councils / the proponent should determine there own depths for areas based on a risk assessment process.

9. CONSTRUCTION PHASE

9.1 Background

The construction/building phase can deliver significant impacts on the environment predominantly through the physical removal of vegetation and disturbance of soil. Off site environmental impacts may also result due to the inappropriate storage of machinery, materials and waste products. Compaction of infiltration areas may result due to vehicles traversing an area. Streambank and/or habitat disturbance may result with the inappropriate removal of vegetation and failure to prevent access to easily disturbed areas. The staging and planning of construction and building works is imperative for successful sediment and erosion control and site rehabilitation.

9.2 Objectives

- To adhere to the Sediment and Erosion Control DCP
- To protect water quality from impacts during the construction phase.
- To protect key vegetation during the construction phase.
- To protect the site's natural properties, such as soil permeability so as to reduce and treat stormwater volumes during the construction phase.
- To ensure construction waste is managed appropriately.
- To minimise soil erosion and site disturbance through planning and source control.
- To minimise transportation of eroded soil by air and water
- Stage ground disturbance/earthworks and progressively revegetate the site to reduce the area contributing sediment.
- To retain topsoil for revegetation works

9.2.1 General Requirements

All works in the construction phase must comply with the relevant local Sediment and Erosion Control DCP.

9.2.2 Requirements for Vegetation Removal.

1. No vegetation is to be removed prior to approval of Council to start work on any stage, and not before the approved sediment control measures are in place.
2. Vegetation removal is to be staged to avoid the complete removal of vegetation on site, and allow the regeneration of vegetation cover.
3. The removal or disturbance of native trees, shrubs and ground covers shall be minimised.
4. Vegetation which is to remain on site is to be clearly marked and fenced off. The immediate areas around vegetation to be retained is to be kept free of vehicle storage, vehicle thoroughfare and material storage.
5. Retained vegetation and buffers must be protected by a suitable fence barrier. Fenced areas shall be clearly signposted "No Access Area".
6. Where practical vegetative debris must be salvaged either as logs or woodchip for later reuse to control erosion or to rehabilitate the site. Non salvageable material, such as stumps and roots, may be removed.

7. Water body buffer zones are to be clearly marked and identified as no go areas. No materials are to be stockpiled in buffer zones. Vehicles are not to traverse or be parked in the buffer zone. The site should be kept free from pedestrian use.

9.2.3 Protection of Stormwater Assets and Treatment Areas.

1. Existing or planned Infiltration areas are to be clearly marked and identified as no go areas. No materials are to be stockpiled in these areas. Vehicles are not to traverse the area or be parked in the area. The site should be kept free from heavy pedestrian use to maintain infiltration properties.
2. Existing or planned Grass swale areas are to be clearly marked and identified as no go areas. No materials are to be stockpiled on areas. Vehicles are not to traverse the area or be parked on the area. The site should be kept free from heavy pedestrian use to maintain infiltration properties.
3. The footpath or nature strip adjoining construction and building sites must not be disturbed by construction activities other than shown on the plan for :
    - access to the site;
    - installation of services;
    - other works specifically approved by Council;

9.2.5 Site Rehabilitation Requirements.

1. Vegetated ground cover is to be re-established within 30 days from any disturbance.
2. All ground disturbed must be progressively stabilised and rehabilitated so it no longer acts as a source of sediment.
3. The final rehabilitation or landscaping program is to be scheduled so that a duration of less than 20 working days will elapse from final land shaping to permanent rehabilitation.
4. All landscaping and rehabilitation must be completed before occupation or use of buildings or premises.
5. Sediment fences must be left in place until vegetated ground cover is established.
6. Topsoil shall be used in accordance with the relevant Council DCP or the manual “Managing Urban Stormwater, Soils and Construction” NSW Dept of Housing 1998 and updates.
7. Revegetation shall be in accordance with the relevant Council DCP or the manual “Managing Urban Stormwater, Soils and Construction” NSW Dept of Housing 1998 and updates.

10.2.5 Access and Roads.

1. Vehicular access must be confined to a maximum of two locations. Such locations will be shown on the ESCP (Erosion and Sediment Control Plan) and subject to the approval of Council.
2. Access to construction sites of 1 hectare or more shall be fitted with a shakedown device. A shakedown device shall be either:-
    - shaker grid (metal bar cattle grid minimum length 7m), placed to ensure vehicles crossing the grid have sufficient speed to shake off mud and contaminants from vehicles or
    - 10m long shake down area constructed with 50mm diameter crushed rock
3. The shakedown device shall be located along the haul route, immediately before the intersection with the public road.
4. Regular maintenance of shake down devices is required to ensure no material is deposited on public roads. Metal shall be cleaned/replaced when the exposed height of aggregate is less than 30mm.
5. Shaker grids are required on sites where more than 1,000m3 of material per month is hauled off site.
6. If material is deposited on a public street, it shall be swept up and removed before the end of that working day.

7. If after using shakedown device, material is still adhering to truck wheels and being deposited on public roads, a wheel washing device must be installed and used at site exit locations to ensure no further material is carted off site and deposited on public roads.
8. Runoff from access surfaces must be drained into an adjacent sediment trapping device before leaving the site. Where appropriate, devices to remove soil particles from vehicles must be placed at site exit locations.
9. On subdivision work, priority must be given to road and shoulder stabilisation based on erosion hazards. Where circumstances preclude the sealing of road shoulders and/or the construction of kerb and gutter, and:
    - where grades permit grass shoulder (less than 5%), the shoulders and associated table drains must be topsoiled and turfed, having dimensions that simplify maintenance mowing; and
    - where grades do not permit grass shoulders (more than 5%), the shoulders and associated table drains must be stabilised with appropriate erosion control measures (e.g. jute mesh and bitumen, cross drains, erosion matting etc.) and revegetated.
8. On subdivision work newly sealed hard stand areas must be swept thoroughly after sealing/surfacing to prevent excess aggregate or gravel entering street drains.

9.2.6 Stormwater Control

1. When roof structures and piped or artificial stormwater systems are in place, discharge water is to be managed in a manner that reduces the likelihood of erosion.
2. The stormwater system must prevent sediment from being eroded from the site and deposited downstream.

9.2.7 Waste Management, Material Storage and Pollution Control

1. No construction materials, building materials, fill material, chemicals, waste, bins, skips or other, are to be stored either in the gutter, footpath or otherwise outside of the site boundary.
2. Petroleum and other chemical products and must be prevented from entering the stormwater system or contaminating the soil.
3. Impervious bunds must be constructed around all fuel, oil or chemical storage areas with an enclosed volume large enough to contain 110% of the volume held in the largest tank.
4. Waste on site is to be stored in a manner which:-
    - Prevents rainwater entry.
    - Has stormwater diverted around it to prevent contamination of surface waters.
    - Prevents wind blown litter from escaping.
5. Adequate trade waste and litter bins must be provided onsite and serviced regularly.
6. Concrete wastes or washings from concrete mixers must not be deposited in any location where those wastes or washings can flow, or can be washed into any areas of retained vegetation or receiving waters.

10. References

The following documents have been reviewed, borrowed upon, and acknowledged for providing baseline material to generate the Clarence Valley Sustainable Water Development Control Plan.

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